People's Republic of China

Ex-Post Evaluation of Japanese ODA Loan Project
Beijing Urban Railway Construction Project

External Evaluator: Masami Tomita, International Development Associates Ltd.

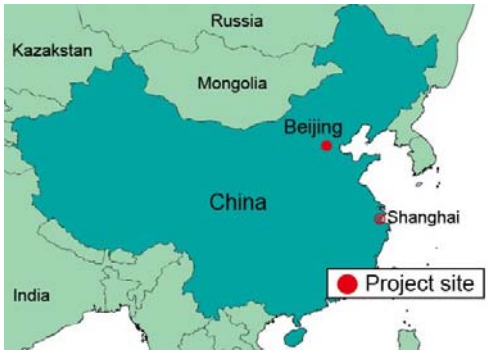
0. Summary

This project aimed at improving transportation networks and reducing traffic congestion along the railroad by constructing railways between Xizhimen and Dongzhimen in the Beijing City, thereby contributing to reduction of aerial pollution and regional development.

Relevance of this project is high, as the project is consistent with priority areas of China's development plans and Japan's ODA policy, and moreover development needs for the project are high. Efficiency of the project is fair, as both project cost and period exceeded the plan while outputs of this project are almost as planned. Effectiveness of the project is high, as the project more or less achieved targets in major operation and effect indicators and beneficiaries showed high level of satisfaction with this project. The overall goal of the project, which is to contribute to regional development, has also been mostly achieved. Sustainability of the project is high, as no major problems have been observed in the operation and maintenance (O&M) system, technical capacity and financial status of the O&M organization.

In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location

Platform of the Lishuiqiao Station

1.1 Background

While reform and door-opening policies of China started in 1979 have brought remarkable economic development and improvement in living standards of its nationals, they also promoted motorization in major cities such as Beijing and Shanghai, which exacerbated traffic congestion. In the Beijing City, the speed of construction of road networks could not meet the increasing

demand for public transportation and construction of subways that enable mass transit was delayed, and consequently, chronic traffic congestion resulted from the increased number of passenger cars. In this situation, the Chinese Government determined to introduce urban transport systems such as subways in cities where population is over 1 million and GDP exceeds 50 billion RMB, aiming at tackling inadequate urban infrastructure and further economic development.

The northern part of the Beijing City, which is located along the urban railway constructed by the project (Line 13), contains residential development areas such as Qinghe Development Zone, Beiyuan Development Zone, and Wangjing Development Zone, etc, which were priority areas to reduce population of the city centre by moving population to suburbs. However, existing means of access from these development areas to the city centre were limited to buses and taxies only, and hence this project possessed high importance in order to cope with population growth in these development areas and materialize migration of population from the city centre to suburbs.

This project was implemented based on an urban development plan that aimed at tackling serious traffic congestion in the Beijing City centre, developing the northern part of the city, and constructing an urban transport system that penetrates to the northern area.

1.2 Project Outline

The objective of this project is to improve transportation networks and reduce traffic congestion along the railroad by constructing railways of approximately 40 km between Xizhimen and Dongzhimen in the Beijing City, thereby contributing to reduction of aerial pollution and regional development. Figure 1 shows the subway map of the Beijing City including the line constructed by the project.

Source: Shanghai Explorer
Note: as of December 30, 2010

Figure 1: Beijing Subway Map

Loan Approved Amount/ Disbursed Amount	14,111million yen / 8,108million yen
Exchange of Notes Date/ Loan Agreement Signing Date	October, 2000 / October, 2000
Terms and Conditions	Interest Rate: 0.95% Repayment Period: 40years (Grace Period: 10years) Conditions for Procurement: Bilateral Tied[1]

[1] This project was implemented utilizing the Special Yen Loan (SYL). SYL was introduced by the Government of Japan in 1998 as one of the financial relief measures for Asian countries suffered from the Asian economic crisis. SYL was to provide concessionary financial assistance for the development of infrastructures in the fields of transportation logistics, foundation for productive facilities and large-scale disaster prevention. The terms and conditions of SYL is set at greater concessionary level than standard terms and conditions of ODA loans, while the eligibility of the prime contractors under SYL is limited to Japanese nationals or judicial persons and procurement

Borrower / Executing Agency	The Government of the People's Republic of China / Beijing Infrastructure Investment Co., Ltd.
Final Disbursement Date	January, 2008
Main Contractor (Over 1 billion yen)	Mitsubishi Corporation (Japan) / Sumitomo Corporation (Japan) / Nissho Iwai Corporation (Japan)
Main Consultant (Over 100 million yen)	None
Feasibility Studies, etc.	The Feasibility Study on the Project of the Beijing Urban Transit Railway Line from Xizhimen to Dongzhimen (Beijing Mass Transit Railway Corporation / Beijing Urban Engineering & Design Institute: July, 1999)
Related Projects	Beijing Subway Construction Project (1)(2) (1988-1992) Beijing Subway Construction Project Phase II (1)(2)(3)(4) (1992-2000)

2. Outline of the Evaluation Study

2.1 External Evaluator

Masami Tomita, International Development Associates Ltd.

2.2 Duration of Evaluation Study

Duration of the Study: October, 2010 – October, 2011

Duration of the Field Study: January 15, 2011 –January 22, 2011, May 8, 2011–May 14, 2011

2.3 Constraints during the Evaluation Study

Beijing Mass Transit Railway Corporation, which originally was the executing agency of the project, was reorganized into the following three companies in 2003; Beijing Infrastructure Investment Co., Ltd. (responsible for finance, investment, and asset management of Light Rail Transit (LRT)), Beijing Mass Transit Railway Operation Co., Ltd. (responsible for O&M of LRT), and Beijing Transit Railway Transportation Construction and Management Co., Ltd. (responsible for construction of LRT). Data and information related to project appraisal and procurement provided from the executing agency was limited, due to the above restructuring and the fact that it has been eight years since the completion of Japan's ODA loan portion of the project (the start of trial operation in some sections). Therefore, evaluation was conducted by supplementing data and information unavailable from the executing agency with those collected from statistical books of the Beijing City, documents provided by JICA, and a beneficiary survey.

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of goods and services under SYL is tied to Japanese goods and services (goods and services whose country of origin being other than Japan can be procured up to no more than 50% of the total loan amount).

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of China

The Ninth Five-Year Plan of the Beijing City (1996-2000) Chapter 4 emphasized construction of urban transportation systems and reduction of traffic congestion, and prioritized construction of rail transit systems such as subways as well as that of roads and airports. Moreover, the Master Plan of the Beijing City (1991-2010) Chapter 11 targeted at increasing the volume of public passenger transportation out of overall passenger transportation to 47.4% in 2000 and to 58.4% in 2010, by promoting construction of urban road networks and rail transit networks, aiming at significant improvement of urban traffic conditions. Lengths of rail transit systems in operation were expected to reach 70km in 2000 and 120km in 2010, and the Master Plan aimed at constructing 12 rail transit lines with lengths of approximately 300km covering the whole Beijing City and satellite cities such as Tongzhou Town, Yizhuang, and Huangcun in a long term.

At the time of ex-post evaluation, the Eleventh Five-Year Plan of the Beijing City (2006-2010) Chapter 3 aims at starting operation of subway Line 4, 5, 10 and the Olympic Line and operating more than 270km in total of rail transit systems in the Beijing City by 2010, in an effort to establish an integrated transport system and reduce traffic congestion. Moreover, the Master Plan of the Beijing City (2004-2020) Chapter 13 aims at construction of an integrated passenger transport system by 2020 centring on rail transit systems, making a public transportation a core transport system. It plans to construct 19 rail lines (15 urban lines and 4 suburban lines) with lengths of approximately 570km in total by 2020, connecting the Beijing City centre with new cities such as Tongzhou, Shunyi, Yizhuang, Daxing, Fangshan, and Changping.

Therefore, development plans of the Beijing City emphasize construction of urban transport systems and rail transit systems including subways both at the time of appraisal and ex-post evaluation.

3.1.2 Relevance with the Development Needs of China

At the time of appraisal, the Beijing City suffered from chronic traffic congestion caused by the increased number of passenger cars including taxies and influx of vehicles from suburbs, partly due to the fact that construction of subways that enable mass transit was delayed. The Line 13 constructed by the project possessed a high importance in order to move population from the city centre to suburbs (residential development areas along the Line 13) and to reduce

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ③High, ②Fair, ①Low

population in the city centre.

At the time of ex-post evaluation, traffic congestion in the city centre has not been solved yet, as the number of passenger cars has been increasing due to increased income and living standards of citizens. However, residential development along the Line 13 has been progressed due to the fact that the Line 13 was opened to operation and it was connected with other lines such as Line 2, 5 and 10. Table 1 shows the transition of the volume of passenger transportation by major modes of transportation in the Beijing City. The number of subway users has been rapidly increasing partly due to the fact that the O&M organization introduced a single fare system (2RMB for all sections) at the end of 2007 in order to increase subway users, and thus needs for construction of subways are high.

Table 1: The Volume of Passenger Transport by Major Modes of Transportation in the Beijing City

(Unit: 10 thousand people / year)

	1998 (Before Project)	2006 (4years after Completion)	2007 (5years after Completion)	2008 (6years after Completion)	2009 (7years after Completion)
Bus	372,494	397,919	422,645	470,863	516,517
Taxi	63,817	64,121	64,111	69,000	68,000
Subway	46,331	70,306	65,493	121,660	142,268

Source: 1998 Data: Appraisal documents, Other data: Beijing Statistical Yearbook (2005, 2007, 2009, 2010)

3.1.3 Relevance with Japan's ODA Policy

The Country Assistance Program for China in Japan's Official Development Assistance Annual Report 1999 emphasized provision of assistance for resolving a delay in construction of economic infrastructures of transportation, communication, and electricity which has been a bottleneck for economic development in China. Of which regarding the transport sector, it planned to provide assistance that contributes to increased transportation capacity through construction of transport/traffic facilities and improvement of maintenance and management capability for transportation efficiency. Moreover, assistance for China's railway sector was prioritized in JICA's Policy for Overseas Economic Cooperation Operations.

This project has been highly relevant with China's development plans, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

Table 2 shows outputs of the project (planned and actual). Outputs of the project were almost as planned. The reason for differences in quantity of power-supply equipments between the

original and actual scopes is unclear, as the executing agency did not have information.

Table 2: Project Outputs (Planned/Actual)

Item	Planned	Actual
Sections	From Xizhimen to Dongzhimen	As planned
Route Length	40.5km (of which underground 1.8km, at-grade 32.2km, elevated 6.5km)	As planned
No. of Stations	16 (of which underground 1, at-grade 14, elevated 1)	As planned
No. of Depot	1	As planned
Rolling Stocks	56 units	As planned
Attached Facilities	Train carried motors, train gear drive devices, train carried braking devices 56 sets	As planned
	Processing and maintenance equipments 4 sets	As planned
	Train carried air conditioners 448 sets	As planned
	Signal system 1 set	As planned
	Radio system 1 set	As planned
	Transmission system 1 set	As planned
	Automatic fare collection system 1set	As planned
	SCADAR system 1 set	As planned
	Heavy duty circuit breaker 370 sets	325 sets
	DC speed circuit breaker 100 sets	168 sets
	Comprehensive protecting devices for computers in propulsion power system 150 sets	117 sets
	Automatic fire alarm and extinguishing system 1 set	As planned

Source: F/S, appraisal documents, documents provided by JICA, interviews with relevant agencies

Rail Tracks near the Huoying Station

Automatic Ticket Gate at the Xizhimen Station

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned project cost at the time of appraisal was 72,725 million yen (foreign currency: 14,111 million yen, local currency: 58,614 million yen), of which Japan's ODA loan portion was 14,111 million yen. On the other hand, the actual project cost was 89,299 million yen (foreign currency: 8,108 million yen, local currency: 81,191 million yen), of which Japan's ODA loan portion was 8,108 million yen, and it was slightly higher than planned (123% against the plan).

According to the executing agency, the reason for the higher project cost in total was due to changes in exchange rates etc. Reasons for the lower Japan's ODA loan portion were that SCADAR system and automatic fire alarm and extinguishing system were procured with local budget instead of ODA loan and that procurement cost turned out to be lower as a result of competitive bidding.

As explained above, this project was implemented utilizing the Special Yen Loan (SYL) and the customer satisfaction survey was conducted during the ex-post evaluation. According to the executing agency, the bid price was not higher than a bid price seen in other similar type of projects in China and the quality of the contractors was at a satisfactory level.

3.2.2.2 Project Period

The planned project period at the time of appraisal was 34 months in total from October 1999[4] to July 2002 (the completion of the project was defined as open to traffic). On the other hand, the actual project period was 36 months in total from October 1999 to September 2002 (the start of trial operation from Xizhimen to Huoying), and it was slightly longer than planned (106% against the plan)[5]. The Line 13 was fully opened in January 2003 and procurement of all rolling stocks was completed in December 2004. However, assembling and acceptance inspection were completed after 2007 due to the fact that some defects were found in wheels, and that rolling stocks were sent back to the ordering party without inspection as Japanese technical staff had to leave because of the spread of SARS in 2003. Consequently, the loan disbursement period was extended till 2008.

Both project cost and project period slightly exceeded the plan, therefore efficiency of the project is fair.

3.3 Effectiveness[6] (Rating: ③)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

(1) Volume of Passenger Transportation

Table 3 shows estimated and actual volume of passenger transportation of the Line 13.

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4 Generally the start of a project is the timing of signing Loan Agreement (L/A), but procurement procedure (local currency portion) such as preparation of bidding documents was started before signing of L/A in this project, and thus in the evaluation of this project the starting point is defined as the start of the procurement procedure.

5 The planned and actual periods from the start of the project to the trial operation are compared in order to evaluate the efficiency of the project, as the completion of the project was defined in L/A as open to traffic as the timing when effects of the project start to be realized.

6 The rating of the project's effectiveness takes into account the evaluation of the project's impact.

Only average daily volume of passenger transportation is available for 2 years after the completion of the project (2004) and the actual volume is about 70% of the estimate. Actual volume reaches almost 80% of the estimate (estimated volume: 185,600 persons/day, actual volume: 153,700 persons/day) in 3 years after the completion of the project (2005). Both actual volume of average daily transportation and that of peak hour exceed estimated volume after 6 years of operation (2008). The number of passengers has steadily been increasing, as many lines that connect with the Line 13 were open to traffic.

Table 3: Volume of Passenger Transportation of Line 13

(Unit: average daily: 10 thousand persons/day, peak hour: persons)

	2 years after completion	4 years after completion	6 years after completion	7 years after completion	8 years after completion
Estimated Volume					
Average Daily	17.26	25.40	33.10	37.78	43.13
Peak Hour[7]	N/A	18,700	24,000	27,100	30,700
Actual Volume					
Average Daily	11.68	19.72	41.12	44.75	49.79
Peak Hour	N/A	16,700	28,200	32,000	35,000

Source: Estimated volume: appraisal documents, actual volume: answer to questionnaire

The Government of the Beijing City has deployed various efforts to reduce traffic congestion in the Beijing City and increase the number of subway users as follows; 1) a single fare system (2RMB for all sections since the end of 2007), 2) free transit to other lines, 3) provision of a bicycle-parking area at stations, 4) restriction on car use (since the Beijing Olympic Game in 2008 the Government has restricted driving cars according to the number on the far right of a car registration plate, for example, people who have a car with 3 or 8 on the far right of a car registration plate cannot drive their cars on Mondays, people who have a car with 4 or 9 on the far right of a car registration plate cannot drive their cars on Tuesdays, etc), and 5) restriction on purchasing cars (since November 2010 the Government has allowed purchasing of 20 thousand cars only per month in the entire Beijing City by making registration of a car plate assigned by lottery).

(2) Number of Running Trains

Table 4 shows the actual number of running trains on the Line 13. The number of running trains per day in 2010 more than doubled since 2005.

[7] Maximum cross-sectional passenger flow per peak hour

Table 4: The Number of Running Trains on Line 13

(Unit: number/day, number/peak hour)

Period	Day	Peak Hour(7:00-9:00) (per hour)
January 2005 – October 2005	234	10
October 2005 – September 2006	287	12
September 2006 – October 2007	334	15
October 2007 – December 2007	461	17
December 2007 – December 2009	481	20
2010 –	499	N/A

Source: answer to questionnaire

(3) Operation Interval

Table 5 shows actual operation interval of the Line 13. Planned operation interval at the time of appraisal was 2 minutes per peak hour, and actual operation interval in 2010 is 3 minutes per peak hour, which is close to the planned figure.

Table 5: Operation Interval of Line 13

(Unit: minute)

Year	Peak Hour	Off-Peak Hour
2003	8	14
2004	6	13
2005	6	13
2006	5	11.5
2007	3.5	9
2008	3	7-8
2009	3	6-8
2010	3	5-8

Source: answer to questionnaire

(4) Rush Ratio[8]

Table 6 shows the actual rush ratio of the Line 13. The ratio is over 100% since 2006. As explained below, in the beneficiary survey about 40% of respondents answered "uncomfortable" regarding the question for the congestion situation of the Line 13. While it would be difficult to solve this issue instantly as the current operation interval is very close to the target, which is 3 minutes per peak hour, there is a room for improvement regarding the congestion situation.

Table 6: Rush Ratio of Line 13

(Unit: %)

	2006	2007	2008	2009	2010
Rush Ratio	103	114	107	114	116

Source: answer to questionnaire

[8] Rush Ratio: the number of passengers per peak hour / transportation capacity per peak hour x 100
Transportation capacity per vehicle is larger in Beijing than that of equivalent size of vehicle in Japan.

(5) Maximum Speed and Operating Rate of Rolling Stocks

The maximum speed was planned as 80km/hour at the time of appraisal and the actual maximum speed in 2010 is 73km/hour[9], which is close to the planned figure. While there is no planned figure for the operating rate of rolling stocks, the actual rate at the time of ex-post evaluation is 73%, calculated from the fact that 41 units out of 56 units comprised of four-car trains are in operation[10]. However, according to the O&M organization, the number of units not in operation includes those in the process of inspection, and thus the operating rate of rolling stocks would be higher if those in inspection are deducted from the number of units not in operation.

(6) Required Time for Specific Sections (Effects of Shortening Travelling Time)

Time required for travelling by subway (Line 13) and by car was measured and compared, by actually travelling by taxi on roads that run parallel to the Line 13 from the Shangdi station to the Xizhimen station during the morning and evening rush hours on weekday. Travelling by subway (Line 13) from Shangdi to Xizhimen requires 13 minutes. As there are several routes that run parallel to the Line 13, two routes were selected; the Route 1: Xiaoying Bridge – Liudaokou – Xuezhi Bridge – Xizhimen, and the Route 2: Shangdi (south) – the East Gate of the Beijing University – Sitong Bridge – the Capital Gymnasium – Xizhimen. Travelling by taxi on the Route 1 and the Route 2 required 32 minutes and 52-55 minutes respectively[11]. The result cannot be generalized as the congestion situation on these routes would vary according to the day of the week and the time of the day, but there is a tendency that required time for travelling by subway (Line 13) is shorter than time required for travelling by cars.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

(1) Financial Internal Rate of Return (FIRR)

While FIRR was estimated as 13.9% at the time of appraisal, due to the fact that data needed for quantitative analysis (yearly disbursement of project cost) was not available, analysis for FIRR was not possible.

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9 Source: O&M organization

10 Source: Same as above. The operating rate was calculated as 41 units in operation / 56 units in total x 100.

11 For the Route 1, the time measurement was conducted from Xiaoying Bridge starting at 8:00 on January 18th, Wednesday, to Xizhimen (32 minutes in total). For the Route 2, the first measurement was conducted from Shangdi starting at 8:00 on May 11th, Wednesday, to Xizhimen (52 minutes in total) and the second measurement was conducted from Xizhimen starting at 17:30 on May 13th, Friday, to Shangdi (55 minutes in total).

(2) Economic Internal Rate of Return (EIRR)

While EIRR was estimated as 19.8% at the time of appraisal, due to the fact that data needed for quantitative analysis (yearly disbursement of project cost, breakdown of benefits such as effects of reducing travelling time, that of reducing fatigue, that of reducing traffic accidents, and that of replacing buses) was not available, analysis for EIRR was not possible.

3.3.2 Qualitative Effects

Beneficiary survey was conducted in the ex-post evaluation[12]. Results are shown below.

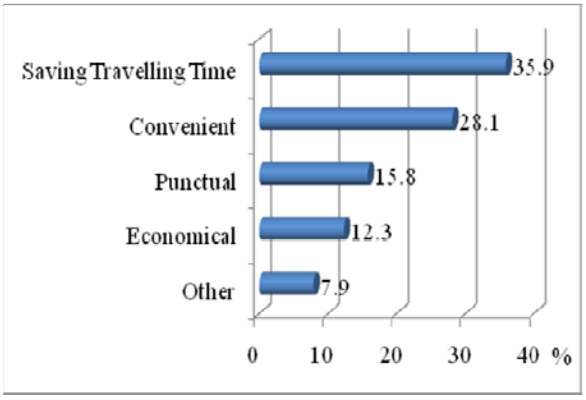


Figure 2: Reasons for Using Line 13

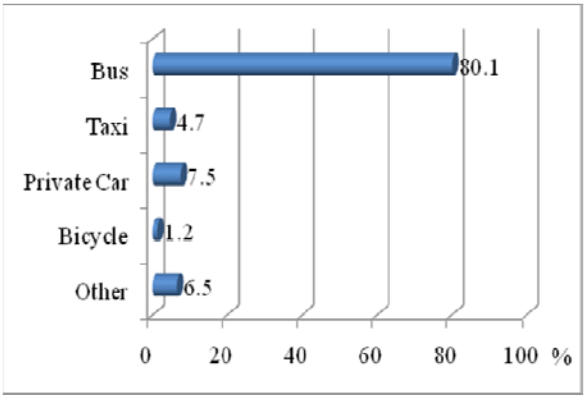


Figure 3: Transportation Used before Opening of Line 13

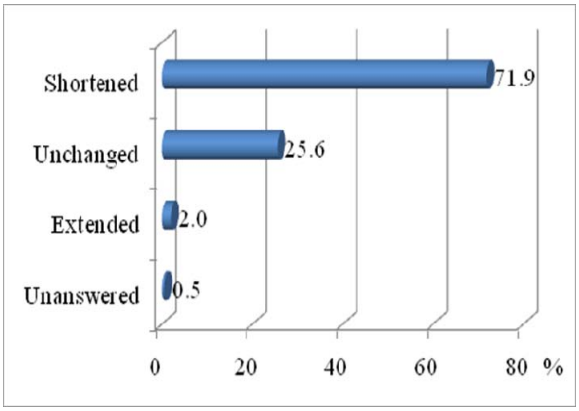


Figure 4: Travelling Time after Opening of Line 13

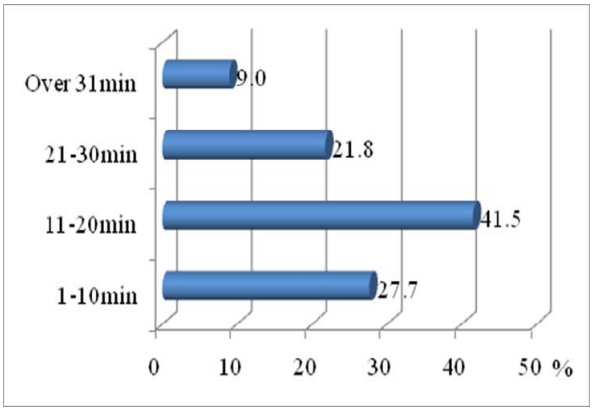


Figure 5: Travelling Time Reduced by Using Line 13

[12] Beneficiary survey was conducted on March 21-23, 2011, at Shangdi, Huilongguan, Lishuiqiao, and Wangjingxi stations. The number of valid response was 402.

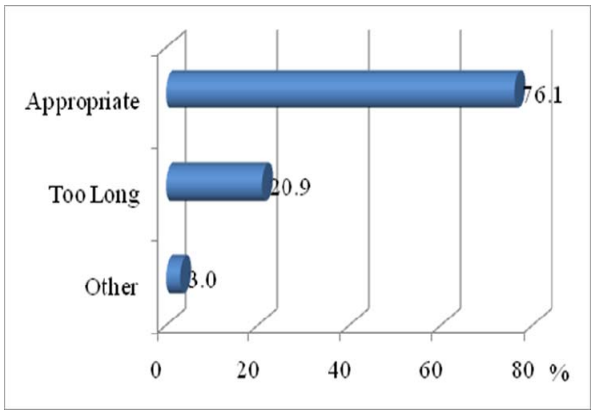


Figure 6: Operation Interval

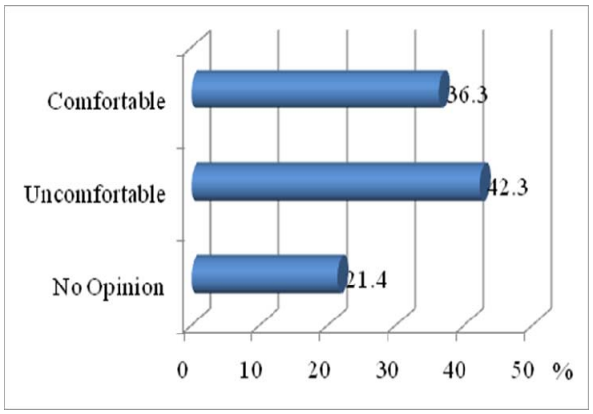


Figure 7: Congestion Situation of Line 13

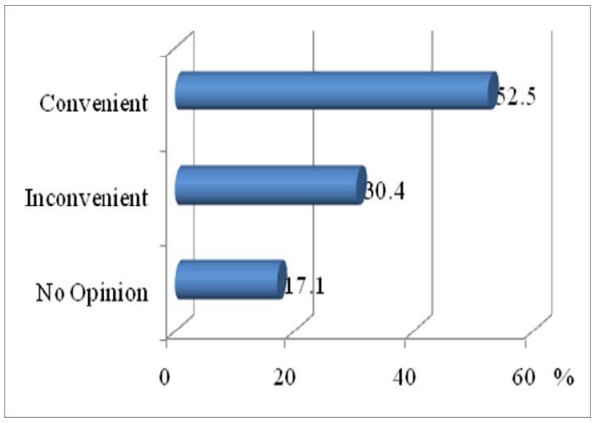


Figure 8: Connection with Other Lines

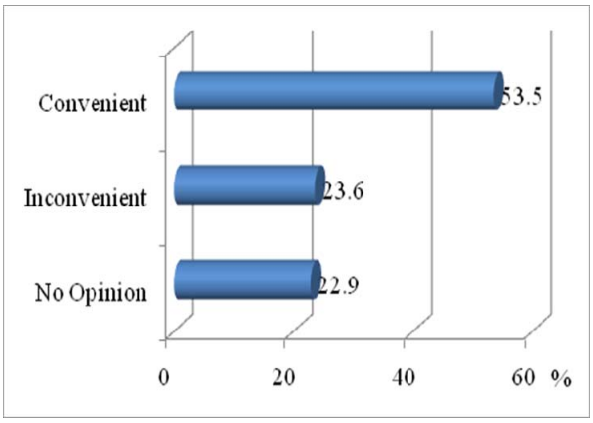


Figure 9: Connection with Other Transportation

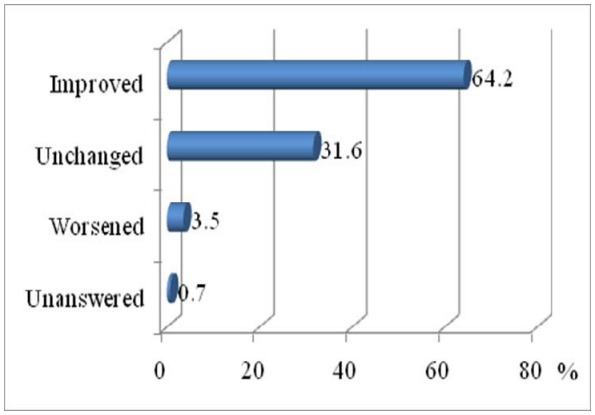


Figure 10: Traffic Congestion on Roads along Line 13

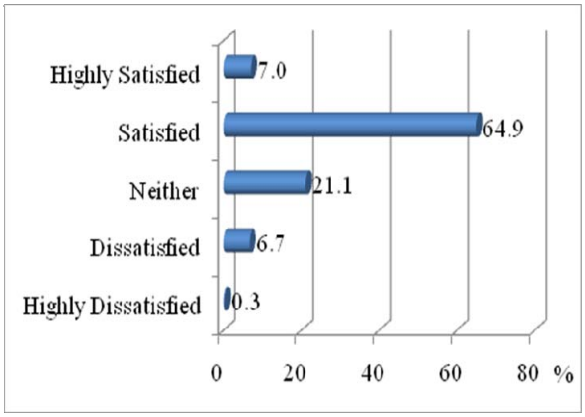


Figure 11: Satisfaction Level about Line 13

More than 70% of respondents replied that travelling time was reduced by using the Line 13, and more than 70% of respondents are satisfied with the project (Line 13), which indicates that there has been an improvement in transportation convenience for citizens due to the project. While it is not possible to completely eradicate traffic congestion of the Beijing City only by this project, more than 60% of respondents replied that traffic

congestion on roads along the Line 13 has been improved and about 12% of people who had used taxies and private cars before opening of the Line 13 shifted to the use of the Line 13, which suggests that this project has contributed to improvement of traffic congestion to some extent, as the congestion would have been worsened if the project had not been implemented.

On the other hand, there is a room for improvement regarding congestion of the Line 13 and connection with other lines and other transportation means, as the number of respondents who are satisfied with these aspects was almost half of the total (about 30% for congestion of the Line 13).

This project has largely achieved its objectives, therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended Impacts

(1) Regional Development along the Line 13

Average housing prices along the Line 13 have been increasing, such as 5,720 RMB/m^2 in 2004, 7,980 RMB/m^2 in 2006, and 9,930 RMB/m^2 in 2007, as residential development has been promoted since the Beijing City centre and suburbs were connected by the Line 13. Particularly, the price increase in the area from Xi'erqi to Huilongguan has been remarkable, and the average sale price of houses in the area in 2007 was 10,842 RMB/m^2, which rose by 33.8% compared with the previous year, according to Zhongda-Hengji Research Centre of Real Estate Marketing. Moreover, while only small commercial buildings were seen around the Lishuiqiao Station previously, the Line 13 is now connected with the Line 5 at this station, and many famous restaurants and fashion brand shops are opened and a shopping centre is being constructed[13].

Residential Development near Lishuiqiao Station

The number of population in districts along the Line 13 has also been increasing, with the residential and commercial developments described above.

[13] Source: sg.com.cn: a popular information portal which posts various information related to life and culture in China, operated by Super-goods Network Technology Co. Ltd

Table 7: District Population along Line 13

(Unit: 10 thousand persons)

	2000	2008	2009
Chaoyang	152	308	318
Haidian	162	293	308
Changping	43	94	102

Source: Beijing Statistical Yearbook (2001, 2009, 2010)

In the beneficiary survey, approximately 70% of respondents replied that there has been development in areas along the Line 13, and they raised examples such as increases in the number of houses and shops, and rise in land prices, which supports the above tendencies. Results of the beneficiary survey are shown below.

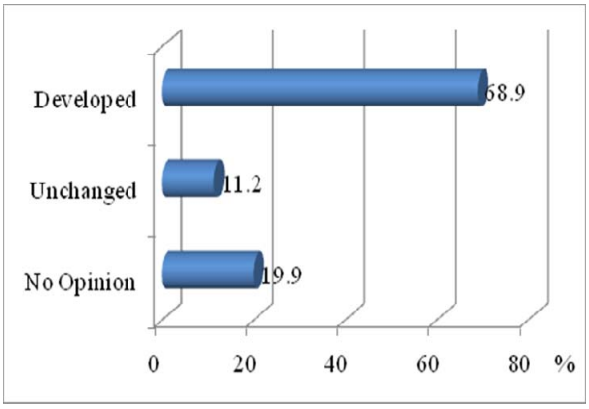


Figure 12: Regional Development along Line 13

Figure 13: Specific Examples of Development

(2) Reduction of Aerial Pollution

As the number of vehicles on major roads in the Beijing City has been increasing with the increase of passenger cars, it is difficult to indicate effects of the project on the reduction of aerial pollution along the Line 13.

3.4.2 Other Impacts

(1) Impacts on the Natural Environment

Major negative impacts on the natural environment were not seen in this project, however, in the beneficiary survey approximately 20% of respondents replied that there have been negative impacts caused by the project, and they raised noise problems for the reason[14]. Staff of the O&M organization also stated that local residents along the Line 13 complain to the Traffic Department of the Beijing City about noise problems, as noise prevention walls were not established along the Line 13 (they were provided for the Line 5).

[14] This is due to the fact that the underground station is only one out of 16 stations, and the other stations are either at grade or elevated.

According to the executing agency, necessary measures planned at the time of appraisal (keeping certain distances between rail tracks and houses) were taken, however, residential density in some areas has increased due to the population growth, which made it difficult to keep the necessary distance between rail tracks and houses, and caused noise problems. Actions are needed such as provision of noise prevention walls, and according to the executing agency, the Government of the Beijing City, the executing agency and residential developers are currently discussing the necessary measures to solve this issue.

(2) Land Acquisition and Resettlement

About 116ha of land was planned to be acquired and about 2,200 households (about 6,000 people) were planned to be resettled for the project at the time of appraisal. While the actual area of land acquired for the project is unknown, the actual number of households resettled was about 1,300 (about 4,000 people)[15]. The reasons for the reduction in number are unknown, as the executing agency did not have the information.

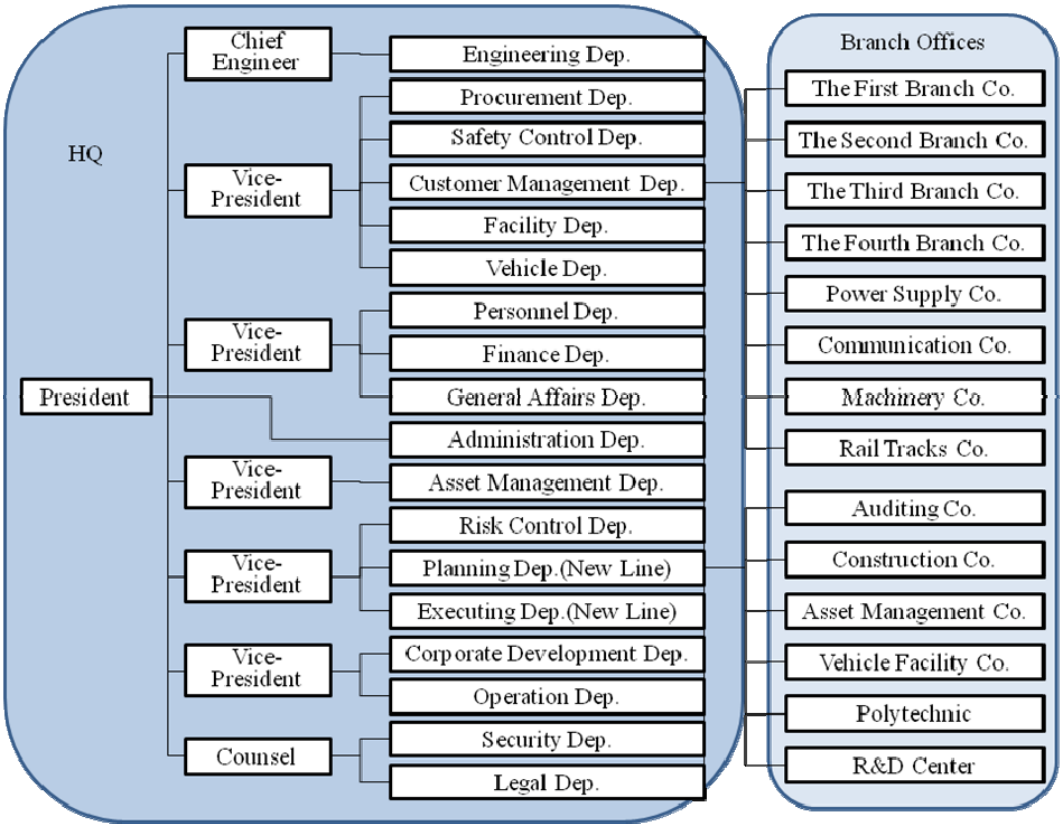
From the above, the overall goal of the project as contribution to regional development is mostly achieved.

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

Beijing Mass Transit Railway Operation Co., Ltd. is responsible for O&M of the Beijing Subway as a whole and the Third Branch Company is responsible for O&M of the Line 13 (the Third Branch Company is responsible for Line 2, 8, 10, and 13). Below is the organization structure of Beijing Mass Transit Railway Operation Co., Ltd.

[15] Source: documents provided by JICA



Source: Beijing Mass Transit Railway Operation Co., Ltd. HP

Figure 14: Organization Structure of Beijing Mass Transit Railway Operation Co., Ltd.

The total number of employees of the Third Branch Company is 3,848, of which about 100 persons are involved in management of vehicles of the Line 13, about 600 persons are involved in management of passengers (station staff) of the Line 13, and about 300 persons are train operators of the Line 13. Sufficient numbers of staff are assigned and there is no problem in the O&M structure.

3.5.2 Technical Aspects of Operation and Maintenance

Beijing Mass Transit Railway Operation Co., Ltd. runs a polytechnic institute and most employees are graduates of the institute. Apart from this, trainings on O&M were provided by the contractor of the project in 2004, and Beijing Mass Transit Railway Operation Co., Ltd. conducts trainings on improvements in safety and service quality once a year for all employees. Problems on technical capacity of these employees were not observed during the interviews with them at the depot and manuals are provided for each facility.

3.5.3 Financial Aspects of Operation and Maintenance

Subway fare is 2 RMB for all sections including the Line 13. Tables below show revenue and O&M cost of the Line 13.

Table 8: Revenue of Line 13

(Unit: 10 thousand RMB)

Year	2006	2007	2008	2009	2010
Fare Revenue	19,777	20,548	18,755	22,256	24,953
Advertising Revenue	800	1,400	2,200	1,600	1,600
Total	20,577	21,948	20,955	23,856	26,553

Source: answer to questionnaire

Table 9: Operation and Maintenance Cost of Line 13

(Unit: 10 thousand RMB)

Year	2006	2007	2008	2009	2010
Cost	22,396	25,714	33,205	37,078	41,676

Source: answer to questionnaire

O&M cost is not covered by operating revenue of the Line 13, as subway fare is set low. However, the deficit is financed by the Government of the Beijing City. The table below shows the financed amount for the Line 13 by the Government for recent years. According to Beijing Mass Transit Railway Operation Co., Ltd., as the importance of the Beijing Subway including the Line 13 is very high for the purpose of improvement of transportation networks and reduction of traffic congestion in the Beijing City, financial support from the Government is expected to continue, and thus there seems to be no problem on financial aspects of O&M.

Table 10: Financed Amount for Line 13 from the Government of the Beijing City

(Unit: 10 thousand RMB)

Year	2008	2009	2010
Amount	39,824	14,518	16,599

Source: answer to questionnaire

3.5.4 Current Status of Operation and Maintenance

Routine inspection and repair (conducting appearance check of major parts and repairing parts that affect safe operation), periodic inspection and repair (overhauling, repairing and replacing electric equipments, braking systems and door systems etc), and major inspection and repair (overhauling and replacing electric equipments, braking systems and door systems etc, fixing and conducting performance recovery of vehicles) are conducted for procured rolling stocks. Regular inspection and repair are also conducted for other facilities such as power supply facilities, and platforms and inside of vehicles are kept clean.

No major problems have been observed in the O&M system, therefore sustainability of the project is high.

Vehicle in Inspection

Operation Room within the Depot

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

Relevance of this project is high, as the project is consistent with priority areas of China's development plans and Japan's ODA policy, and moreover development needs for the project are high. Efficiency of the project is fair, as both project cost and period exceeded the plan while outputs of this project are almost as planned. Effectiveness of the project is high, as the project more or less achieved targets in major operation and effect indicators and beneficiaries showed high level of satisfaction with this project. The overall goal of the project, which is to contribute to regional development, has also been mostly achieved. Sustainability of the project is high, as no major problems have been observed in the O&M system, technical capacity and financial status of the O&M organization.

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) (Recommendation to the Government of the Beijing City)

This project has largely contributed to the improvement of transportation networks in the Beijing City, however, the percentage of beneficiaries who are satisfied with the status quo regarding connections of the Line 13 with other subway lines and other transportation means (such as buses) is only about 50%. While various measures are already being planned, for example, operating shuttle buses from Tiantongyuan Station of the Line 5 to areas along the line and providing parking areas called "park-and-ride" at stations connecting the Line 13 and Line 8, it is desirable to improve connections of the Line 13 and other transportation means, for example, by increasing the number of buses connecting stations of the Line 13 with residential areas along the line.

(2) (Recommendation to the Executing Agency)

As noise problems were raised in the beneficiary survey, it is desirable to provide noise prevention walls along the Line 13 as has been done for the Line 5.

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

Reasons for the steady increase of passengers of the Line 13 as planned would be various measures taken by the Government of the Beijing City to increase subway users such as a single fare system and restrictions on car use and purchasing cars, as well as the fact that many of other subway lines are in operation. While a single fare system might not be feasible in some cases as it makes it difficult to secure O&M budget, to implement various urban strategies together with a railway construction project would be of high value.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs	・ Sections: Xizhimen – Dongzhimen ・ Route Length: 40.5km (underground 1.8km, at-grade 32.2km, elevated 6.5km) ・ No. of Stations: 16 (underground 1, at-grade 14, elevated 1) ・ No. of Depot: 1 ・ Rolling Stocks: 56 units ・ Train carried motors, train gear drive devices, train carried braking devices 56 sets ・ Processing and maintenance equipments 4 sets ・ Train carried air conditioners 448 sets ・ Signal system 1 set ・ Radio system 1 set ・ Transmission system 1 set ・ Automatic fare collection system 1set ・ SCADAR system 1 set ・ Heavy duty circuit breaker 370 sets ・ DC speed circuit breaker 100 sets ・ Comprehensive protecting devices for computers in propulsion power system 150 sets ・ Automatic fire alarm and extinguishing system 1 set	As planned As planned As planned As planned As planned As planned As planned As planned As planned As planned As planned As planned 325 sets 168 sets 117 sets As planned
2. Project Period	October 1999 – July 2002 (34 months)	October 1999-September 2002 (36 months)
3. Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	 14,111million yen 58,614 million yen (4,727 million RMB) 72,725million yen 14,111million yen 1RMB = 12.4 yen (As of January 2000)	 8,108 million yen 81,191 million yen (5,646 million RMB) 89,299million yen 8,108million yen 1RMB = 14.38 yen (Average between October 2000 and January 2008)